# *STAURASTRUM VOLANS* VAR. *FUQUENENSE* NOV. VAR., AN INTERESTING DESMID TAXON IN THE PHYTOPLANKTON OF LAGUNA FUQUENE (COLOMBIA) [1]

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## RESUMEN

Se describe una nueva variedad de la laguna de Fúquene situada en los Andes de Colombia, perteneciente a la especie *Staurastrum volans* W. & G. S. West, conocida hasta ahora solamente de Africa. A juzgar por los datos ecológicos de las localidades colombianas y de las registradas en los hábitat africanos, *S. volans* puede caracterizarse ecológicamente como una especie planctónica de desmidias, bien adaptada a medios eutróficos e inestables, cuyo pH osciló entre neutro a ligeramente alcalino.

## ABSTRACT

Of *Staurastrum volans* W. & G. S. West, previously only known from Africa, a variety fuquenense Coesel is newly described from laguna Fúquene in the Colombian Andes. Judging from the ecological data of the localities in Colombia and from those recorded from African habitats, *Staurastrum volans* may be characterized ecologically as a planktonic desmid species that is well adapted to neutral to somewhat alkaline, eutrophic and unstable habitats.

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[1] Studies on Colombian Cryptogams XXVI.

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## INTRODUCTION

Laguna Fúquene, one of the larger natural lakes in the Colombian Andes, has a phytoplankton composition dominated by blue greens, diatoms and, to a lesser extent, coccalean green algae. The green algal family Desmidiaceae, quantitatively playing second fiddle, is represented by some ten species.

One of these desmid taxa is a representative of the genus *Staurastrum* showing a strong affinity to *S. volans* W. & G. S. West, a species previously only known from Africa.

## TAXONOMIC DESCRIPTION

*Staurastrum volans* W. & G. S. West var. **fuquenense** Coesel nov. var.

Cellulae, processibus pro portione brevioribus et constrictione minore non tam graciles quam in varietate nominata, biradiatae aut triradiatae sunt. Longitudo sine processibus 17-23 μm; latitudo sine processibus 10-13 μm, cum processibus 30-50 μm; latitudo isthmi 7-8,5 μm. Typus: figura nostra 2a.

*Staurastrum volans* as described by WEST & WEST (1895, p. 79, t. 9: 10-11) is characterized by a smooth-walled, rather deeply constricted cell body and arm-like processes with undulate margins and deeply bifurcate apices. The semicells, in frontal view cyathiform with a convex apex, are almost circular in top view (Fig. 1). Although described as biradiate in the original diagnosis, it was later found that *S. volans* may also occur as a triradiate form (RICH 1932, f. 14 a-d). Both in dimensions and morphology our alga agrees with the description of *S. volans,* except for the depth of constriction of the cell body (Fig. 2). From the dimensions given by WEST & WEST (l.c.) a ratio breadth of isthmus: breadth of cell body equalling 2/5 can be deduced, while this ratio is 2/3 in our material. The less slender habitus of our alga as compared with *S. volans* as illustrated in WEST & WEST (l.c.), RICH (l.c.), COMPÉRE (1970, f. 244) and THOMASSON (1955, f. 24, as *S. americanum* forma) is also brought about by the relatively shorter processes, but presumably this characteristic is of lesser taxonomic importance than the proportional breadth of the isthmus.

*S. volans* (in its typical variety) is known from several regions in Africa: Madagascar, the Transvaal, Kenya and Chad. It had previously not been reported from other continents, but may be closely associated with *S. americanum* (W. & G. S. West) G. M. Smith (see RICH 1932, p. 180), a taxon both recorded from North America (WEST & WEST 1896, SMITH 1921, 1924) and from South America (GRÖNBLAD 1945). Although they superficially resemble one another, there is an essential difference between these two species when seen in apical view: the outline of the cell body is almost circular in *S. volans*

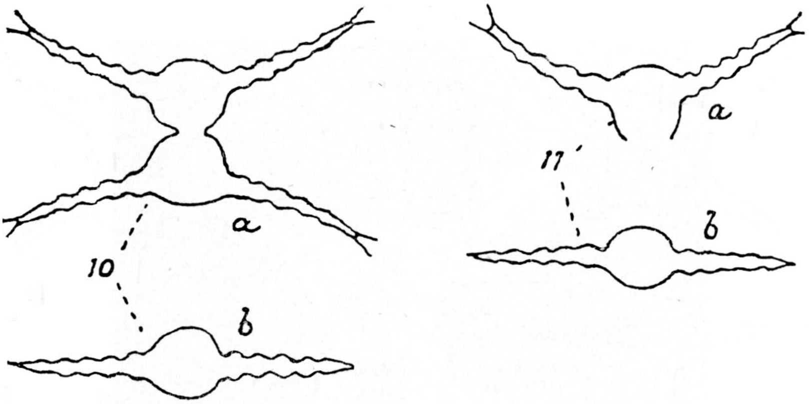

FIGURE 1. Reproduction of *Staurastrum volans* after West & West (1895, t. 9: 10-11).

as against elliptic in *S. americanum*. On that account an identification of our material as *S. americanum* is decidedly out of the question.

*S. volans* var. *fuquenense* was identified by the senior author in the framework of a broad inventory of desmid assemblies that was made in different climatological regions and various ecological habitats in Colombia in February and March 1985. Apart from the laguna Fúquene locality (Colombian collection nrs. 11, 12 and 14), where the taxon forms a regular component of the phytoplankton, it was later abundantly encountered in the Ciénaga de Guarinocito, situated at the río Magdalena near Honda (collection nrs. 61 and 65, see Fig. 3).

## LAGUNA FUQUENE AND ITS PHYTOPLANKTON COMPOSITION

Laguna Fúquene is located in the North of the department of Cundinamarca in the eastern Cordillera at an altitude of 2543 m. Its geographical situation is 5° 28' 12" N and 73° 44' 14" W. It is of Prequaternary, tectonic origin so that conditions orignated favourable for the accumulation of lacustrine sediments. Nowadays the lake covers an area of approximately 30 $km^2$ and has a volume fluctuating from 45 to 90 million $m^3$ with an average depth of 1 metre, and a maximum depth of 7 metres. Laguna Fúquene forms part of the hydrologic system of the Ubaté Valley, mainly fed by the río Ubaté from the South and draining to the North through the río Suárez.

The lake has a mean water temperature of 15° C, the pH ranges from 6 to 8, whilst the electric conductivity at the date of sampling by the senior author varied between 200 and 300 $\mu S\ cm^{-1}$ (at 25°C). The water is charac-

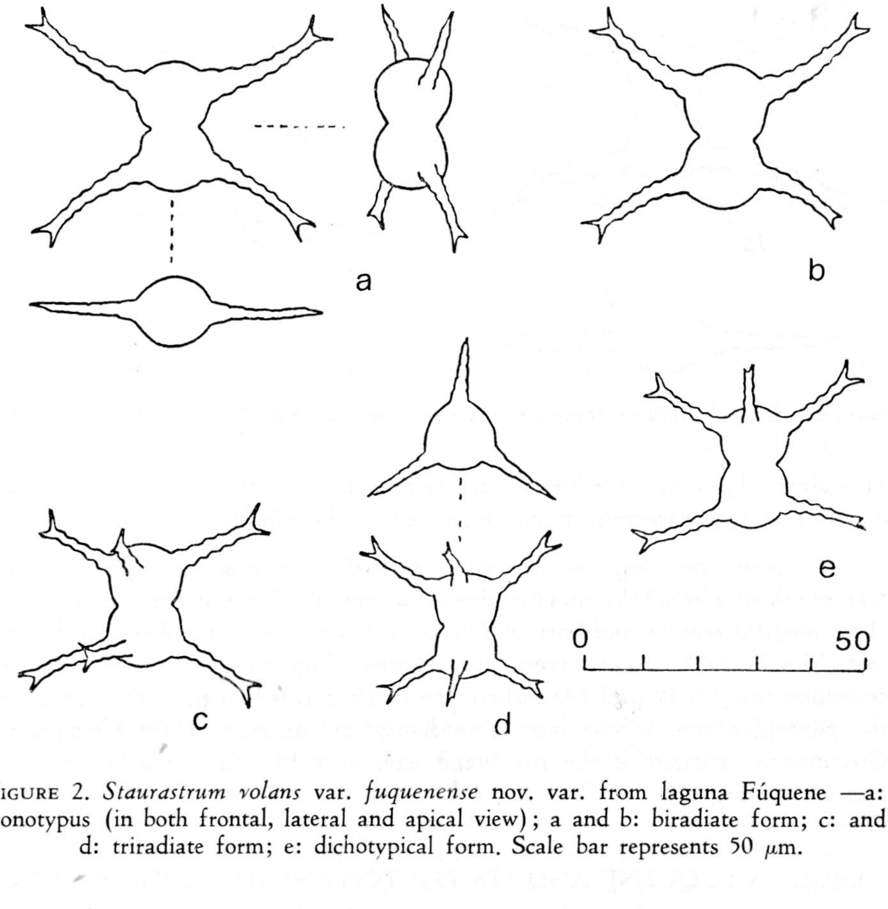

FIGURE 2. *Staurastrum volans* var. *fuquenense* nov. var. from laguna Fúquene —a: iconotypus (in both frontal, lateral and apical view); a and b: biradiate form; c: and d: triradiate form; e: dichotypical form. Scale bar represents 50 $\mu$m.

terized by a high degree of turbidity, its transparency measured by means of a secchi disk usually being only 15-20 cm. This turbidity is partly attributable to the high sediment content of the supplying river water and partly to turbulence of the lake water through wind action (because owing to the shallowness there is no stratification). The high silt content emanates from severe erosion all over the Ubaté Valley as a result of large-scale forest destruction. In addition there is some artificial eutrophication and pollution by fertilizers and sewage from the surrounding countryside. Despite the appreciable amount of nitrogen and phosphorus compounds (for details, see DONATO & DUQUE 1986), the phytoplankton density is not very high. The number of algal specimens ranges from 1000-10.000 $ml^{-1}$, the number of individual algal cells from 10.000-100.000 $ml^{-1}$ and there is never any visible sign of algal bloom. An excess of ammonium over nitrate indicates a rate of decomposition higher than

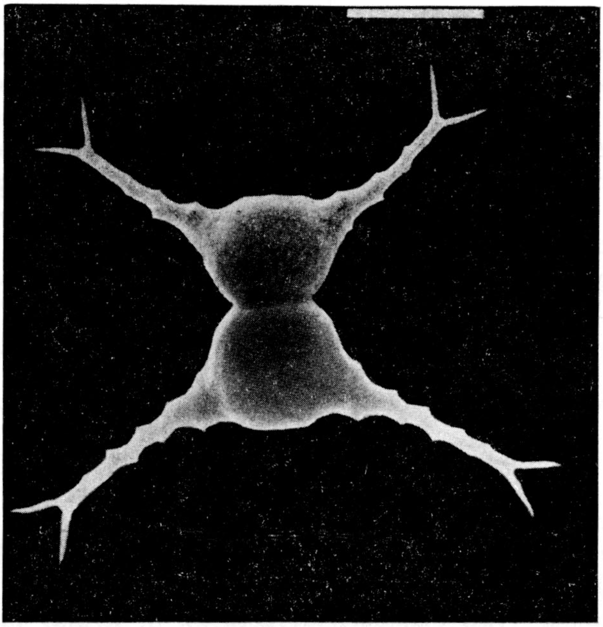

FIGURE 3. Scanning electron microscopic view of *Staurastrum volans* var. *fuquenense* from ciénaga de Guarinocito. Scale bar represents 10 $\mu$m.

that of the primary production. This relatively low primary production may be ascribed to the light insufficiency caused by the high turbidity of the water but also to the high iron and calcium content of the clayey sediment and consequent sequestering of N-and P-compounds in solution (DONATO & DUQUE l.c.). In contrast to the low primary production of the phytoplankton there is a luxuriant development of littoral macrophytes (especially of *Eichhornia crassipes* and *Myriophyllum elatinoides*) creating ecological niches for benthic and tychoplanktonic micro-organisms.

The euplankton community mainly consists of algal species said to be well adapted to a strong turbulence and a high turbidity, such as the blue-greens *Anabaena circinalis, Anabaena spp.* and *Microcystis aeruginosa,* and the diatoms *Melosira granulata* and *M. italica* (MARGALEF 1978, 1983). Among the quantitatively less important group of green algae *Dictyosphaerium pulchellum* and *Botryococcus braunii* predominate. The desmid flora is characterized by *Staurodesmus dejectus, S. lobatus* var. *ellipticus, Staurastrum volans* var. *fuquenense, S. chaetoceras, Closterium limneticum* and *C. acutum.* The last three taxa are well-known in Europe as frequent inhabitants of eutrophic, turbid water types (COESEL 1984). It is noteworthy in this connection that, generally speaking the few desmid species encountered in eutrophic, unstable habitats have relatively small dimensions and a high rate of reproduction, so that they can compete with the likewise fast dividing, blue-greens, diatoms and coccalean algae (COESEL 1982). The information that *Staurastrum volans* was also encountered in the Ciénaga de Guarinocito, which, like most ciénagas, is characterized by a relatively high rate of secondary production and of decomposition (with Euglenophyta and Cyanophyta as the main algal groups), supports the idea that the above-mentioned species, unlike the great majority of the desmids, is well adapted to a life in turbid, nutrient-rich water types. This is in agreement with the records of its occurrence in African habitats (e. g. RICH 1932).

## POPULATION DYNAMICS OF *S. VOLANS* VAR *FUQUENENSE* IN LAG. FUQUENE

In the course of one year of monthly sampling (April 1984, April 1985) *S. volans* var. *fuquenense* attained its maximum abundance in May and in July (Fig. 4). A similar frequency distribution is demonstrated by most of the other desmids (viz., *Staurodesmus dejectus, S. lobatus* var. *ellipticus, Staurastrum chaetoceras* and *Closterium limneticum*), by the chlorococcaleans *Dictyosphaerium pulchellum, Botryococcus braunii* and *Pediastrum duplex*, and by the diatom *Melosira italica*. The increase in number of cells of these species coincides with an increase in the nitrogen/phosphorus ratio of the lake water. Whereas the normal value for this ratio is 15, in the two months mentioned an increase to over 30 was shown to occur (DONATO & DUQUE 1986). Whether it is this raised ratio, possibly resulting in a phosphorus limitation, or, for instance, a possibly coinciding decrease in turbidity of the water favouring the development of the above-mentioned species is unclear and will be the subject of further studies.

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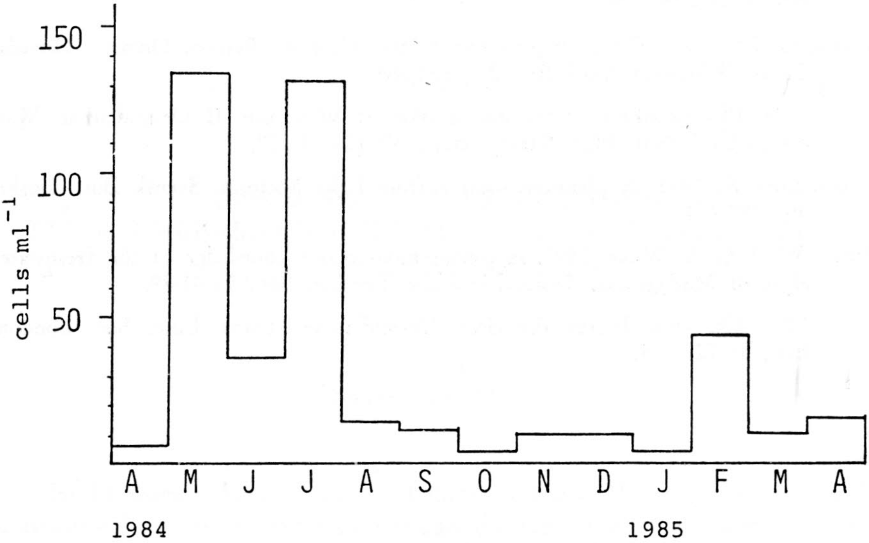

FIGURE 4. Abundancy of *Staurastrum volans* var. *fuquenense* in the course of one year of monthly sampling at a permanent station in laguna Fúquene (for details about the sampling procedure, see DONATO & DUQUE 1986).

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